BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Subsidiary Diploma in Engineering (360 GLH) 601/7584/9 Pearson BTEC International Level 3 Foundation Diploma in Engineering (540 GLH) 601/7591/6 Pearson BTEC International Level 3 Diploma in Engineering (720 GLH) 601/7580/1 Pearson BTEC International Level 3 Diploma in Electrical and Electronic Engineering (720 GLH) 601/7579/5 Pearson BTEC International Level 3 Diploma in Mechanical Engineering (720 GLH) 601/7583/7 Pearson BTEC International Level 3 Diploma in Manufacturing Engineering (720 GLH) 601/7582/5 Pearson BTEC International Level 3 Extended Diploma in Engineering (1080 GLH) 601/7588/6 Pearson BTEC International Level 3 Extended Diploma in Electrical and Electronic Engineering (1080 GLH) 601/7587/4 Pearson BTEC International Level 3 Extended Diploma in Mechanical Engineering (1080 GLH) 601/7590/4 Pearson BTEC International Level 3 Extended Diploma in Digital Engineering (1080 GLH) 601/7586/2 Pearson BTEC International Level 3 Extended Diploma in Manufacturing Engineering (1080 GLH) 601/7589/8
Unit number and title	**Unit 30: Mechanical Measurement and Inspection Technology**
Learning aim(s)	**C:** Explore statistical process control to inspect components and increase productivity **D:** Carry out a process capability study to establish machine suitability for a given application
Assignment title	Exploration of statistical process control to inspect components and improve productivity and to establish machine suitability
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You are a third year technical apprentice and you have been asked by your supervisor to contribute to the quality standards for particular products because your company feel that they need to develop their quality processes. The company feel that using statistics will enable them to enhance the quality of their product and so they are considering statistics to examine processes and wish you to evaluate what is available and then to apply the best methods to a particular product.

Task 1	The company produce a small component that has a hole in it that is critical and checked with a plug gauge. The company produce these in batches of 50 and initially carries out 100% inspection. The company are concerned that the process is not in control and have asked you to investigate. Table One gives the defects for 50 batches which you need to use to produce attribute control charts, np and p charts. Table Two gives the next 100 batches. You are expected to: 1. construct the control charts np and p using table one, 2. document your research into ways in which the data can be used to inform the company about the process; 3. determine the extent that the process is under control using that data in table two
	The tables on following pages give the actual sizes of the diameter "A" and length "B" of a stud that the company produces on one of their CNC machines. Design statistical variable control charts involving the mean and range, X and R charts for diameter A. The measurements were taken in batches of 5 and recorded on the table as 1-5 first batch, 6-10 second batch etc. Use the first 50 entries [10 batches] to do this. 1. construct the control charts X and R using this data, 2. document your research into ways in which the data can be used to inform the company about the process; 3. determine the extent that the process is under control using the rest of the data in the table for diameter A, remember these are in batches of 5. Using the data in the table for the length B of the stud produce: 1. a statistical process capability chart for length B for the first 100 studs. 2. an evaluation regarding the machine's capability based on a calculation of Cp and Cpk for the length of the stud, and how the process can be improved. 3. produce a modified control chart and plot the rest of the data from the table for the length B of the stud Produce a report that includes: • An evaluation of the use of the statistical methods possible and how they have influenced the design and successful use of process control charts. • A Process Capability Study based on your outcomes from the data used from the table for the length B of the stud. The size for dimension A is 12.5mm ±0.3. The sizes given in the table are in millimetres. The size for dimension B is

	20.2mm ±0.2. The sizes given in the table are in millimetres.
Checklist of evidence required	A report that contains: 1. evidence of research into statistical process control. 2. an analysis of the data displayed for the attribute and variable control charts that show the upper and lower control limits. 3. evidence of research into statistical process control. 4. an analysis of the data given using a process capability study displaying the data in an appropriate way. 5. an analysis and evaluation of the processes used to make the stud and the machines capability to perform the processes using Cp and Cpk values and a modified control chart.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
30/CD.D3	Evaluate how statistics have influenced the design and successful use of process control charts and a capability study to demonstrate where an improvement to the process can be achieved
30/C.M4	Analyse, an in-control process using a statistical process control procedure involving variable control and attribute charts in relation to effectiveness of variation control and the outcomes from their use.
30/D.M5	Analyse as part of a process capability study the accuracy of a process and produce a modified control chart, explaining its use.
30/C.P4	Explain how the principles of statistics and graphical analysis are applied to represent and display variation found during inspection.
30/C.P5	Design and use a statistical process control procedure involving variable control and attribute charts.
30/D.P6	Design a process capability study.
30/D.P7	Perform a process capability study to establish if a machine is capable of producing components to the required precision.

Sources of information to support you with this Assignment	Drake P (1999) Dimensioning and Tolerancing Handbook McGraw-Hill, ISBN 0070181314 Griffith G. 2001 Geometric Dimensioning and Tolerancing: Applications and Inspection Prentice Hall, ISBN 9780130604637 Oakland J. 2008 Statistical Process Control, Routledge, ISBN 978-0-7506-6962-7 Timings R. L. 2002 Fundamentals of Engineering Newnes, ISBN 0750656093

Table One

Batch Number	Batch Output	Batch Defects
1	100	17
2	100	19
3	100	11
4	100	3
5	100	2
6	100	17
7	100	15
8	100	13
9	100	14
10	100	5
11	100	12
12	100	2
13	100	19
14	100	14
15	100	18
16	100	17
17	100	14
18	100	20
19	100	20
20	100	2
21	100	15
22	100	19
23	100	16
24	100	14
25	100	11
26	100	9
27	100	3
28	100	6
29	100	5
30	100	20
31	100	20
32	100	17
33	100	5
34	100	18
35	100	8
36	100	4
37	100	6
38	100	18
39	100	17
40	100	7
41	100	11
42	100	9
43	100	19
44	100	19
45	100	20
46	100	7
47	100	5
48	100	9
49	100	7
50	100	20

Table Two

Batch Number	Batch Output	Batch Defects		Batch Number	Batch Output	Batch Defects
51	100	19		101	101	2
52	100	20		102	102	10
53	100	12		103	103	21
54	100	15		104	104	13
55	100	12		105	105	3
56	100	18		106	106	3
57	100	17		107	107	6
58	100	15		108	108	2
59	100	18		109	109	10
60	100	15		110	110	5
61	100	19		111	111	14
62	100	11		112	112	12
63	100	4		113	113	14
64	100	12		114	114	16
65	100	11		115	115	7
66	100	3		116	116	14
67	100	17		117	117	6
68	100	5		118	118	2
69	100	13		119	119	9
70	100	15		120	120	19
71	100	17		121	106	8
72	100	7		122	107	14
73	100	10		123	109	12
74	100	14		124	111	17
75	100	17		125	104	13
76	100	5		126	110	13
77	100	15		127	103	9
78	100	11		128	108	18
79	100	4		129	112	18
80	100	11		130	111	5
81	100	4		131	106	7
82	100	14		132	107	17
83	100	16		133	109	12
84	100	11		134	111	16
85	100	14		135	104	12
86	100	2		136	110	13
87	100	16		137	103	9
88	100	6		138	108	12
89	100	12		139	112	18
90	100	16		140	111	5
91	100	9		141	106	8
92	100	10		142	107	14
93	100	16		143	119	12
94	100	9		144	111	17
95	100	3		145	104	18
96	100	13		146	110	17
97	100	15		147	113	9
98	100	13		148	108	18
99	100	15		149	112	17
100	100	8		150	111	6

TABLE 3

Dimension A

1	12.488	51	12.613	101	12.717	151	12.358	201	12.359
2	12.685	52	12.678	102	12.618	152	12.437	202	12.711
3	12.636	53	12.475	103	12.359	153	12.699	203	12.617
4	12.448	54	12.643	104	12.453	154	12.570	204	12.719
5	12.470	55	12.539	105	12.383	155	12.565	205	12.444
6	12.381	56	12.669	106	12.663	156	12.628	206	12.397
7	12.383	57	12.699	107	12.345	157	12.469	207	12.730
8	12.403	58	12.410	108	12.391	158	12.451	208	12.692
9	12.611	59	12.551	109	12.696	159	12.582	209	12.413
10	12.520	60	12.612	110	12.501	160	12.355	210	12.474
11	12.666	61	12.390	111	12.383	161	12.611	211	12.537
12	12.404	62	12.520	112	12.409	162	12.542	212	12.527
13	12.627	63	12.697	113	12.606	163	12.707	213	12.646
14	12.580	64	12.324	114	12.591	164	12.652	214	12.467
15	12.414	65	12.429	115	12.604	165	12.498	215	12.601
16	12.636	66	12.405	116	12.668	166	12.657	216	12.549
17	12.538	67	12.587	117	12.658	167	12.646	217	12.395
18	12.553	68	12.545	118	12.521	168	12.559	218	12.671
19	12.424	69	12.441	119	12.466	169	12.551	219	12.474
20	12.681	70	12.402	120	12.458	170	12.699	220	12.556
21	12.365	71	12.390	121	12.389	171	12.495	221	12.385
22	12.675	72	12.708	122	12.408	172	12.365	222	12.515
23	12.413	73	12.355	123	12.506	173	12.602	223	12.391
24	12.624	74	12.357	124	12.447	174	12.613	224	12.468
25	12.617	75	12.528	125	12.555	175	12.445	225	12.542
26	12.324	76	12.534	126	12.441	176	12.488	226	12.496
27	12.537	77	12.693	127	12.447	177	12.702	227	12.536
28	12.446	78	12.353	128	12.484	178	12.489	228	12.389
29	12.610	79	12.714	129	12.595	179	12.525	229	12.491
30	12.622	80	12.459	130	12.467	180	12.355	230	12.372
31	12.370	81	12.490	131	12.612	181	12.355	231	12.584
32	12.499	82	12.496	132	12.432	182	12.359	232	12.623
33	12.342	83	12.611	133	12.636	183	12.557	233	12.426
34	12.515	84	12.476	134	12.570	184	12.471	234	12.559
35	12.573	85	12.510	135	12.404	185	12.550	235	12.677
36	12.444	86	12.403	136	12.401	186	12.585	236	12.475
37	12.348	87	12.629	137	12.516	187	12.592	237	12.628
38	12.553	88	12.518	138	12.401	188	12.572	238	12.579
39	12.359	89	12.551	139	12.330	189	12.349	239	12.457
40	12.365	90	12.492	140	12.647	190	12.478	240	12.383
41	12.652	91	12.366	141	12.351	191	12.582	241	12.663
42	12.359	92	12.496	142	12.660	192	12.731	242	12.462
43	12.522	93	12.506	143	12.625	193	12.685	243	12.493
44	12.362	94	12.364	144	12.487	194	12.533	244	12.536
45	12.643	95	12.403	145	12.692	195	12.520	245	12.607
46	12.348	96	12.692	146	12.711	196	12.422	246	12.569
47	12.423	97	12.343	147	12.388	197	12.654	247	12.609
48	12.432	98	12.627	148	12.543	198	12.693	248	12.675
49	12.603	99	12.581	149	12.343	199	12.663	249	12.450
50	12.696	100	12.412	150	12.551	200	12.709	250	12.719

TABLE 4

Dimension B

1	20.028	51	20.066	101	20.077	151	20.169	201	20.147
2	20.065	52	20.074	102	20.144	152	20.164	202	20.116
3	20.014	53	20.114	103	20.083	153	20.114	203	20.109
4	20.047	54	20.046	104	20.089	154	20.101	204	20.199
5	20.088	55	20.117	105	20.141	155	20.093	205	20.165
6	20.050	56	20.114	106	20.057	156	20.158	206	20.146
7	20.017	57	20.058	107	20.067	157	20.086	207	20.155
8	20.073	58	20.086	108	20.147	158	20.133	208	20.110
9	20.102	59	20.072	109	20.108	159	20.166	209	20.135
10	20.028	60	20.106	110	20.081	160	20.125	210	20.115
11	20.058	61	20.129	111	20.072	161	20.124	211	20.125
12	20.012	62	20.060	112	20.071	162	20.132	212	20.193
13	20.060	63	20.048	113	20.109	163	20.155	213	20.149
14	20.105	64	20.120	114	20.144	164	20.176	214	20.136
15	20.060	65	20.065	115	20.132	165	20.109	215	20.140
16	20.098	66	20.054	116	20.069	166	20.114	216	20.189
17	20.044	67	20.080	117	20.094	167	20.102	217	20.140
18	20.065	68	20.116	118	20.101	168	20.117	218	20.133
19	20.084	69	20.088	119	20.150	169	20.096	219	20.184
20	20.109	70	20.036	120	20.089	170	20.147	220	20.124
21	20.015	71	20.131	121	20.152	171	20.131	221	20.128
22	20.107	72	20.045	122	20.113	172	20.169	222	20.152
23	20.047	73	20.079	123	20.091	173	20.146	223	20.206
24	20.045	74	20.115	124	20.122	174	20.103	224	20.177
25	20.073	75	20.111	125	20.144	175	20.121	225	20.131
26	20.089	76	20.124	126	20.146	176	20.104	226	20.129
27	20.017	77	20.068	127	20.136	177	20.128	227	20.162
28	20.065	78	20.079	128	20.114	178	20.105	228	20.152
29	20.048	79	20.114	129	20.149	179	20.189	229	20.210
30	20.051	80	20.048	130	20.076	180	20.125	230	20.198
31	20.094	81	20.063	131	20.108	181	20.135	231	20.138
32	20.061	82	20.072	132	20.081	182	20.100	232	20.184
33	20.106	83	20.101	133	20.104	183	20.143	233	20.194
34	20.051	84	20.110	134	20.078	184	20.165	234	20.185
35	20.020	85	20.130	135	20.120	185	20.106	235	20.131
36	20.054	86	20.093	136	20.080	186	20.186	236	20.162
37	20.019	87	20.141	137	20.078	187	20.129	237	20.162
38	20.062	88	20.129	138	20.117	188	20.097	238	20.196
39	20.085	89	20.095	139	20.090	189	20.129	239	20.197
40	20.039	90	20.057	140	20.099	190	20.150	240	20.126
41	20.103	91	20.079	141	20.168	191	20.192	241	20.127
42	20.031	92	20.095	142	20.145	192	20.166	242	20.122
43	20.092	93	20.051	143	20.123	193	20.177	243	20.176
44	20.100	94	20.062	144	20.115	194	20.163	244	20.182
45	20.122	95	20.132	145	20.111	195	20.181	245	20.174
46	20.120	96	20.139	146	20.160	196	20.124	246	20.128
47	20.071	97	20.066	147	20.101	197	20.169	247	20.164
48	20.058	98	20.144	148	20.148	198	20.122	248	20.162
49	20.025	99	20.120	149	20.123	199	20.101	249	20.158
50	20.102	100	20.108	150	20.096	200	20.135	250	20.204